BOOM OR BUOY BARRIER WITH TUBE WITHIN A TUBE FLOATATION CONSTRUCTION

Field of the invention

[0001] The present invention relates to floatation devices and arrangements for use in security barriers for boats and other watercraft, as well as barriers for water facilities or for limiting swimming areas, as warning devices for water hazards or other dangerous areas, and as debris barriers, among other uses.

Description of the Related Art

[0002] Although, as is evident from the foregoing, the invention is not limited to such an application, an important application of the present invention is for use as a "log boom" or barrier. Such barriers are used to, for example, protect dams and other sites accessible by water. Conventional log barriers comprise elongate cylindrical plastic members which resemble logs and which are secured together end to end to form a security barrier for preventing boats and other watercraft from getting too close to the dam or other structure. A variety of different plastic log booms have been used, and a major disadvantage of such log booms is that they frequently crack and/or sink to the bottom over a relatively short period of time. This has proved to be very costly particularly in terms of the labor hours needed to repair the existing commercial log barrier systems.

Summary of the Invention

[0003] According to the invention, a floatation device is provided which overcomes or substantially reduces the problems associated with prior art log booms and other barriers and which can be adapted for use in all of the various applications mentioned above.

[0004] In accordance with the invention, there is provided a floatation barrier or buoy device, as well as floating barrier systems employing such floatation devices. As indicated above, the devices and systems can be used in a number of different applications, including the prevention of unauthorized entry of watercraft into restricted

areas along lakes, harbors and navigable rivers. The floatation devices are of a "tube within a tube" construction with two spaced regions each containing a separate internal floatation medium, and this redundant construction prevents sinking of the device even if both of the tubes are pierced or punctured so as to admit water. In addition, the provision of a metallic outer tube or layer is important in that the materials of construction therefor last longer than the plastic outer shells used in conventional log booms. Further, as described herein, the use of an outer tube or layer permits additional structures, e.g., a superstructure and/or a depending structure, to be welded thereto, and enables signage to be carried by the resulting barrier unit.

[0005] As will appear, in contrast to the prior art, the basic construction is easily adaptable to a wide range of sizes, lengths and heights, thus providing a great deal of flexibility in meeting the needs of users.

[0006] In accordance with a first aspect of the invention, there is provided a floatation device for use as a barrier, the floatation device comprising:

[0007] an outer elongate tubular member fabricated of metal;

[0008] an inner elongate tubular member concentric with said outer tubular member and spaced therefrom so as to form a cavity therebetween;

[0009] a floatation medium within said cavity; and

[0010] a floatation medium within said inner tubular member.

[0011] Preferably, the outer tubular member is comprised of a metal selected from the group consisting of steel, stainless steel and aluminum.

[0012] Preferably, the inner tube is comprised of a material selected from the group consisting of steel, stainless steel, aluminum and a polymer material. In one preferred implementation, this material comprises a hard plastic polymer material. Advantageously, the plastic material comprises polyvinylchloride pipe.

[0013] The floatation medium both within the cavity and within the inner tubular member preferably comprises a medium selected from the group consisting of a gas, a liquid and a solid floatation material. Advantageously, the floatation medium within said inner tubular member comprises a foam. The foam preferably comprises an epoxy foam. The floatation medium within the cavity preferably comprises a foam wrapping.

[0014] Preferably, the floatation device includes a connection member at opposite ends thereof.

[0015] In an important implementation, the floatation device includes a mounting member for enabling the mounting of a superstructure thereon.

[0016] In another important implementation, the floatation device further comprises a barrier structure depending downwardly, in use, from the outer tubular member. In one embodiment, the depending barrier structure comprises a fabric barrier for underwater debris.

[0017] Advantageously, the device further includes a plurality of elongate protective barrier elements projecting outwardly from the outer tubular member.

[0018] In accordance with a further aspect of the invention, there is provided a floating barrier device comprising:

[0019] at least one floatation device comprising an outer metallic member, an inner member defining an inner space disposed within, and spaced from, the outer member so as to define a cavity therebetween, a floatation medium disposed in said cavity, and a floatation medium disposed in said inner space, and

[0020] a superstructure mounted on said at least one floatation device.

[0021] The superstructure preferably comprises an open framework including at least two longitudinally extending connector members.

[0022] Preferably, the barrier device further comprises at least one sign secured to at least one of the connector members of the superstructure.

[0023] Preferably, the at least one floatation device comprises a plurality of said floatation devices connected together to form a barrier.

[0024] According to yet another aspect of the invention, there is provided a floating barrier device comprising a plurality of elongate floatation devices each comprising an outer metal member, an inner member defining an inner space and disposed within the outer member so as to define a cavity therebetween, a floatation medium in said inner space, and a floatation medium within said cavity, said floatation devices being connected together in serial relation to form a floating barrier.

[0025] Preferably, the at least one of the floatation devices includes a superstructure carrying warning signage.

[0026] In one important implementation of this aspect of the invention, a pair of said floatation devices form a barrier unit, a plurality of barrier units are provided, and the barrier units are connected together in end to end relation wherein at least one floatation device of one barrier unit is connected to at least one floatation device of a further barrier unit. In one embodiment, the barrier units are further connected together end to end by a further floatation device. In another embodiment, the barrier units are further connected together end to end by a cable member interconnecting a further floatation device of said one barrier unit and a further floatation device of said further barrier unit.

[0027] Further features and advantages of the present invention will be set forth in, or apparent from, the detailed description of preferred embodiments thereof which follows.

Brief Description of the Drawings

[0028] Figure 1 is a broken away, perspective view of a portion of a barrier floatation device constructed in accordance with a preferred embodiment of the invention;

[0029] Figure 2 is a perspective view of a barrier device or unit incorporating two floatation devices corresponding to that shown in Figure 1, and also including a depending barrier member or skirt;

[0030] Figure 3 is an end elevation view of the barrier unit of Figure 2 with the depending skirt omitted and projecting barrier elements added;

[0031] Figure 4 is a top plan view of the barrier unit of Figure 3;

[0032] Figure 5 is a side elevation view of the barrier unit of Figure 2, with the depending skirt omitted and with signage added;

[0033] Figure 6 is a barrier device in accordance with a further embodiment of the invention which incorporates vertically extending floatation devices corresponding to that of Figure 1;

[0034] Figure 7 is a perspective view of a barrier arrangement or system incorporating a plurality of barrier units and devices corresponding to those of Figures 2 to 5 and of Figure 1, in accordance with one embodiment of the invention;

[0035] Figure 8 is a perspective view of a further barrier arrangement or system which is similar to that of Figure 7, but is constructed in accordance with a further embodiment of the invention;

[0036] Figure 9 is an exploded, partially broken away perspective view showing one embodiment of an arrangement for connecting a superstructure to a floatation device corresponding to that of Figure 1; and

[0037] Figure 10 is a side elevational view of a connection arrangement for connecting two floatation devices together, in accordance with a preferred embodiment of the invention.

Description of the Preferred Embodiments

[0038] Referring to Figure 1, there is shown a perspective view of a floating barrier or floatation device broken away to show the basic construction thereof. The device, which is generally denoted 10, includes an outer shell or layer 12 which is preferably tubular in shape and preferably made of a metal. In accordance with a preferred implementation, the metal is one of either steel, stainless steel or aluminum. In this regard, for some applications, such as in the use of floatation device 10 as a log boom, stainless steel is preferred in some regards in that, for example, it is estimated that stainless steel should have a life expectancy of at least 30-40 years. However, the cost of stainless steel is a disadvantage. Aluminum is also a very good candidate material because of its very light weight, making the resultant floatation device 10 relatively easy to handle and install. A very rough estimate of life expectancy for aluminum is 15-30 years depending on the reaction thereof to the water in which the device is employed. Steel, and, in particular, mild steel, is also a good choice in some applications, although it will be appreciated that other metals could also be used. Preferably, the outer shell or tubular member 12 is coated with a corrosion coating to extend the life thereof. Further, a coating of a color that serves to provide a warning, i.e., bright red or orange, can also be applied.

[0039] The floatation device 10 further includes an inner member 14 which is preferably tubular and concentric with, and spaced from, outer member 12. Member 14

can also be made of steel, stainless steel or aluminum as well as a polymer material such as a hard plastic (e.g., polyvinylchloride or PVC).

[0040] An annular space or cavity 16 is formed or defined between tubular members 12 and 14 and this cavity 16 is filled with a floatation medium preferably selected from the group consisting of a gas (e.g., a gas at atmospheric pressure), a liquid that provides floatation, and a solid floatation material such as a closed cell floatation foam. Such a foam is indicated at 18 in Figure 1.

[0041] A further space or cavity 20 is formed or defined inside of inner tubular member 14 and this space is similarly filled with a floatation medium such as those described. In the illustrated embodiment, a floatation foam 22 is employed.

[0042] In one preferred embodiment, foam 18 is a foam wrap, and foam 22 is an epoxy foam, i.e., a polyurethane epoxy foam.

[0043] It will be appreciated that the tube-in-tube construction of Figure 1 with two separate (e.g., foam) floatation means 18 and 22 prevents sinking of device 10 even if tubular members 12 and 14 are pierced or otherwise compromised.

[0044] Although the dimensions of device 10 will, of course, depend on the application, in an exemplary non-limiting embodiment, outer shell or tube 12 is formed from 0.109 inch stainless steel tubing of a 12 inch diameter, foam 18 is a 2 inch foam wrapping, inner tube 14 is 3/16 inch PVC pipe of an 8 inch diameter, and, as indicated above, foam 22 is an epoxy foam. Again, all of these parameters, including tube thickness and diameter, are subject to change depending on the application.

[0045] Referring to Figures 2 to 5, there is shown one preferred embodiment of the invention which incorporates two floatation devices 10 corresponding to that shown in Figure 1. Although in another important embodiment of the invention, a plurality of floatation devices corresponding to that shown at 10 in Figure 1 are simply connected together end-to-end in serial relationship to form a barrier chain or buoy line, and, to this end, connector elements 24, which are described in more detail hereinbelow in connection with Figure 10, are provided at opposite ends thereof. In the embodiment of Figures 2 to 5, the two floatation devices 10 form a base for a barrier member 26 including an open framework superstructure 28. As illustrated, and is perhaps best seen in Figure 2, devices 10 are connected together by transverse struts 30 and the

superstructure 28 includes V-forming members 28a, an upper longitudinal connector 28b, two intermediate longitudinal connectors 28c and four short, angled, bottom struts 28d. The superstructure 28 can be affixed to the floatation devices 10 by welded brackets described below in connection with Figure 9.

[0046] As shown in Figure 5, the longitudinal connectors 28b and 28c of superstructure 28 can be used to support suitable signage, such as warning signs 32.

[0047] As indicated in Figure 2, a depending structure 34, which may take the form of a durable fabric or mesh, is provided so as to prevent or deter underwater intrusion or to act as a barrier for debris. Alternatively, or in addition, as shown in Figures 3 and 4 one or more of the devices 10 of barrier member 26 may include protective projecting elements 36, such as spikes or sharp blades, which act as a deterrent to intruding boats or other watercraft. Alternatively, or in addition, connectors 28b and 28c may also include such protective projecting elements.

[0048] Although, again, the size of barrier 26 can vary widely depending on application, in order to provide an indication of the scale generally contemplated here, in typical barrier application, the barrier member 26 can be from about 2-10 feet high and 2-24 feet long.

[0049] Referring to Figure 6, a further embodiment of the invention is shown. In contrast to other embodiments wherein the floatation devices extend horizontally, similarly to a log boom or pontoon, the floatation devices of Figure 6 extend vertically, similarly to a buoy. In the illustrated embodiment, four floatation devices 10 support a superstructure 28 corresponding to that shown in Figures 2 to 5 and comprised of corresponding elements. Base or bottom connectors 38 are provided which are connected to devices 10 and provide base framework for superstructure 28. A central plate 40 or other connecting arrangement is used to connect together the four devices 10 at intermediate points along the height (length) of the devices.

[0050] As indicated above, a plurality of individual devices corresponding to that shown at 10 in Figure 1 can be connected together end-to-end in series relation to form a barrier chain or system, and such an embodiment is important for example, when a low barrier is all that is required. In a variant of this embodiment, one or more barriers, corresponding to that shown in Figures 2 to 5, can be inserted into the chain at various

spaced locations therein so as to, for example, provide warning signs along the chain or line.

[0051] In yet another embodiment illustrated in Figure 7, a more robust and impregnable barrier chain or line, indicated generally at 42, is provided which is formed by a series of barrier units 26 corresponding to that shown in Figures 2 to 5. Barrier units 26 are interconnected by individual floatation devices 10 corresponding to that of Figure 1. More specifically, although it will be appreciated that only a part or portion of barrier 42 is shown, in the portion thereof illustrated in Figure 7, a first barrier 26A is connected at one end to a second barrier 26B and to a lone or individual floatation device 10A. The latter is connected to a similar device forming part of a third barrier 26C, while one floatation device of barrier 26B is also connected to barrier 26C while the other floatation device thereof is connected to a second individual floatation device 10B. Finally, in the portion of barrier chain 42 illustrated in Figure 7, barrier 26C and floatation device 10B are also connected to a further (fourth) barrier 26D.

[0052] Referring to Figure 8, an embodiment similar to that of Figure 7 is shown. The barrier chain or system is denoted 44 in Figure 8 and this embodiment differs from that of Figure 7 in that the four barriers, which are denoted 26A, 26B, 26C and 26D, are of a truncated form with trapezoidal end portions in contrast to the triangular end portions of Figure 7. More importantly, floatation devices 10A and 10B are replaced by cables 46A and 46B. It will, of course, be understood that such cables can also be used with the embodiment of Figure 7 to replace floatation devices 10A and 10B. Cables 46A and 46B are preferably stainless steel cables, although other cabling can also be used.

[0053] The embodiment of Figure 8 provides three holding points, viz., cable, floatation device (barrier), cable. It would be very difficult to break all three points at once and if one breaks, two other holding points are still in place.

[0054] It is noted that, with respect to the barrier systems or barrier chains described above, an arch can be formed by using shorter and longer barriers or booms, and fencing and lights can also be added to enhance security.

[0055] Referring to Figure 9, a detail is shown of one approach to mounting superstructure 28 on floatation device 10. In this embodiment, transverse strut element

or strut 30 forms part of the superstructure 28, i.e., an integral framework is provided of which strut member or element 30 is a part, and element 30 is secured by suitable means, e.g., connecting bolts or like fasteners (not shown, although the connection is indicated in dashed lines) to a mounting bracket 48 which has a curved lower edged matching the curvature of device 10 and which is secured to, i.e., welded to, device 10.

[0056] Referring to Figure 10, there is shown a preferred embodiment of the connector or connecting arrangement for providing a connection between adjacent barrier floatation devices 10. As indicated above, in connecting the devices 10, the barrier devices are arranged so that the ends thereof are lined up, and thus, so that the connector elements 24 (also referred to as strength members) are disposed adjacent to each other. The connection between strength members 24 is made by an arrangement comprising connector plates 50, pivot tubes 52, hex bolts 54, hex nuts 56 and fender washers 58. The plates 50 are preferably made of neoprene. Advantageously, a plurality of connector plates 50 are used (e.g., two, four or six depending on the strength rating).

[0057] In making a connection, a plate 50 is placed on the corresponding connection pivot tube 52 which is located at the distal end of the respective strength member 24, and a retaining hex bolt 54 is inserted through a corresponding fender washer 58 and a pivot tube 56, as illustrated. An anticorrosive thread lubricant (not shown) is provided on the threads of the bolt 54 to prevent galling. A further fender washer 58, and a hex nut 56 are placed on the free end of hex bolt 54, and the nut and bolt assembly is tightened until the assembly is tight against the pivot tube 52. The process is then repeated for the adjacent strength member 24.

[0058] Optionally, U-shackles 60 and a high strength link connector 62 can be used to provide additional holding power. In this implementation, the shackles 60 are welded or otherwise affixed to the respective strength members 24.

[0059] It will be appreciated from the foregoing that the barrier or buoy device of the invention, and the floating barrier systems created thereby, can be used in a number of different applications, including the prevention of unauthorized entry of relatively small watercraft (e.g., of a length less than about 100 feet) into restricted areas along lakes, harbors and navigable rivers. This use is particularly important in this new era of

increasing homeland security. Further, as indicated above, the redundant "tube within a tube" construction with two internal floatation means (e.g., as indicated at 18 and 22, respectively) prevents sinking thereof even if both of the tubes 12 and 14 are pierced. In addition, the provision of the metallic outer tube or layer 12 is important in that the materials of construction therefor last longer than the plastic shells used in conventional log booms. Further, the use of metal provides increased versatility in that it permits additional structures to be welded to the basic floatation devices or devices as described above and enables warning signage to be carried thereby.

[0060] As will be appreciated, the basic construction of the floatation device is easily adaptable to a wide range of sizes, lengths and heights, thus providing a great deal of flexibility in meeting the needs of a user. Competing systems, typically made of plastic, are typically available in one size with the plastic components thereof molded to a specific, standard size and form.

[0061] Although the invention has been described above in relation to preferred embodiments thereof, it will be understood by those skilled in the art that variations and modifications can be effected in these preferred embodiments without departing from the scope and spirit of the invention.